Life in Kyrgyzstan

HUMBOLDT-UNIVERSITÄT ZU BERLIN

Michael Bödecker

Weather Shock Experience and Risks Preferences of Livestock Keepers

-

Evidence from Kyrgyzstan

Structure

1. Motivation
2. Theoretical background
3. Data
4. Methodology
5. Results
6. Discussion
7. Conclusions

Motivation

- Livestock keeping represents the main source of income for low-income households in developing countries besides crop farming (FAO, 2015)
- Risk preferences become central in farmers' decision-making processes, e. g. coping strategies, investment behavior, risk evaluation (Meraner & Finger, 2019)
- Agricultural production heavily relies on climate variability
- Literature on the relationship between shock experience and risks preferences is mainly inconclusive (Chuang & Schlechter, 2015; Reynaud & Aubert, 2019; Schildberg-Hörisch, 2018)

Research objective: Investigating the relationship between weather shock experience and risks preferences of livestock keepers in a transition economy context

Theoretical background

- Economic theory assumes stability of risks preferences (Stigler & Becker, 1977)
- Behavioral theory suggests behavioral learning through experiences (Freudenreich et al., 2017)
- The empirical literature on the relationship between shock experience and risks preferences is mainly inconclusive (Chuang & Schechter, 2015; Reynaud & Aubert, 2019; Schildberg-Hörisch, 2018)
- Three arguments:
  - 'Break even hypothesis' (Thaler & Johnson, 1990) → Risk-seeking
  - 'House money effect' (Thaler & Johnson, 1990) → Risk-aversion
  - Stability of risks preferences over time

Kyrgyz livestock sector

- Over 90 % of the country's territory is covered by mountains
  → Scarcity of arable land (UNISDR, 2007)
- Livestock plays a central role in the rural economy (Broka et al., 2016)
- Number of privatizations reforms since 1991 (Robinson, 2020; Wilson, 1997)
- Livestock is mainly kept on pastures (Broka et al., 2016; Fay, Block & Ebinger, 2010)
- Highly vulnerable to climate change → Expected climate trends vary between regions (World Bank, 2017)

Data

1. Life in Kyrgyzstan (LiK)

- Multi-topic, tracking a total of over 3,000 households and 8,000 individuals
- Different elicitation methods of risks preferences

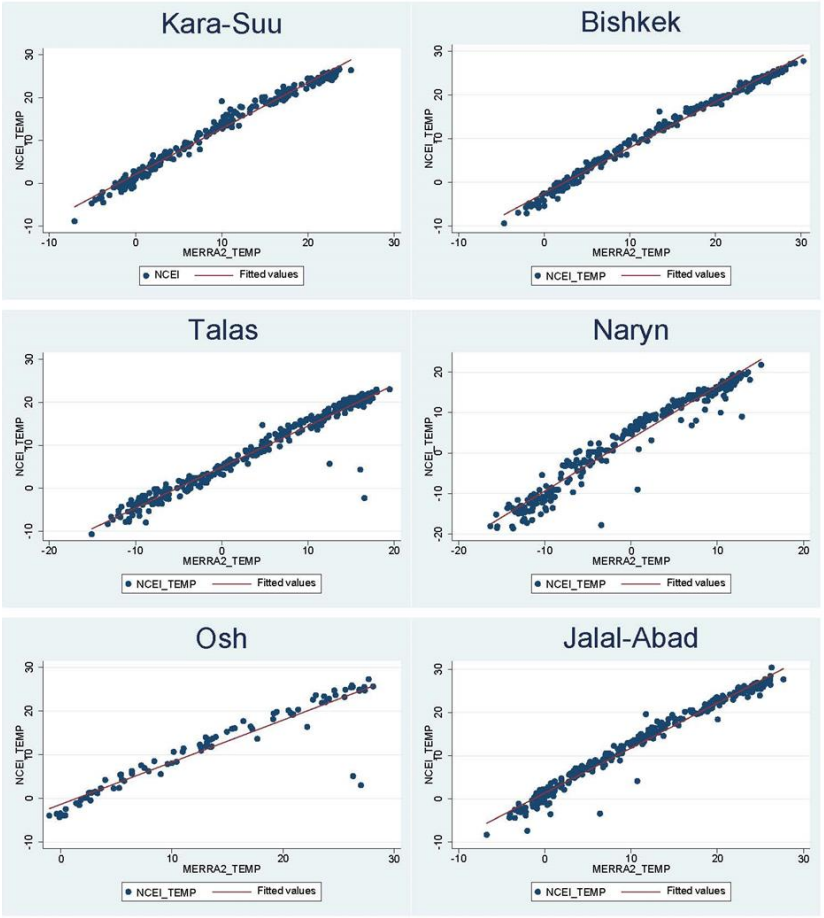
→848 Livestock keeping households are considered for the regression analysis →1,351 individuals involved in animal raising

2. NASA MERRA-2

- Derived from NASA based on satellite observations and an algorithm model to obtain global coverage → Proven to be accurate and reliable (e. g. Van Wart et al., 2015)

→ Based on the coordinates of each community weather data was merged with LiK survey data

Scatterplots of monthly temperature data



Source: NASA POWER (2022), NOAA NCEI (2022); own illustrations

Methodology

1. Measurement of weather shocks

- Following the definition of outlier values (Osborne & Overbay, 2004)
- Consideration of months between Jan 2010 and Sep 2016
- Consideration of extremely hot and extremely cold months (**Temp**) and of months with extremely high, extremely low rainfall and extremely heavy snowfall (**Precip**)

2. Measurement of risks preferences

a) Self-assessment: „How do you see yourself (..) willing to take risks(..)?“

- 0-10 scale: 0 “*completely unwilling to take risks*” → 10 “*completely willing to take risks*”

→ Lower range represents risk aversion

b) Incentivized measures: Lottery game & selling situation

- Five options each with two outcomes A and B
- Rising expected payoff and difference between two outcome

→ Option 1 each represents risk aversion (outcome A and B equal)

Estimated model: MLE-Method

$$Pr(y = 1|x_1, \dots x_i) = F(z) = \frac{e^z}{(1 + e^z)}$$ with $$z = \propto + \beta_1 * x_1 + \dots + \beta_i * x_i = \propto + \beta_i X_i$$

Source: Gujarati et al., 2012

- Series of simple logit models using different elicitation methods of risk aversion
- Binary dependent variable Y takes 1 for “risk aversion” and 0 for “no risk aversion”
- $\beta_i X_i$: Vector of explanatory control variables for individual, household and weather characteristics
  - The number of weather shocks (months) is considered as independent variable

Descriptive statistics

Individual characteristics

- N 1,351

	Mean	Std. dev.	Min.	Max.
Education (Scale 1-8)	4.097705	0.5504899	1	7
Age (in years)	37.08734	15.80073	18	66
Male	0.5566247	0.4969673	0	1

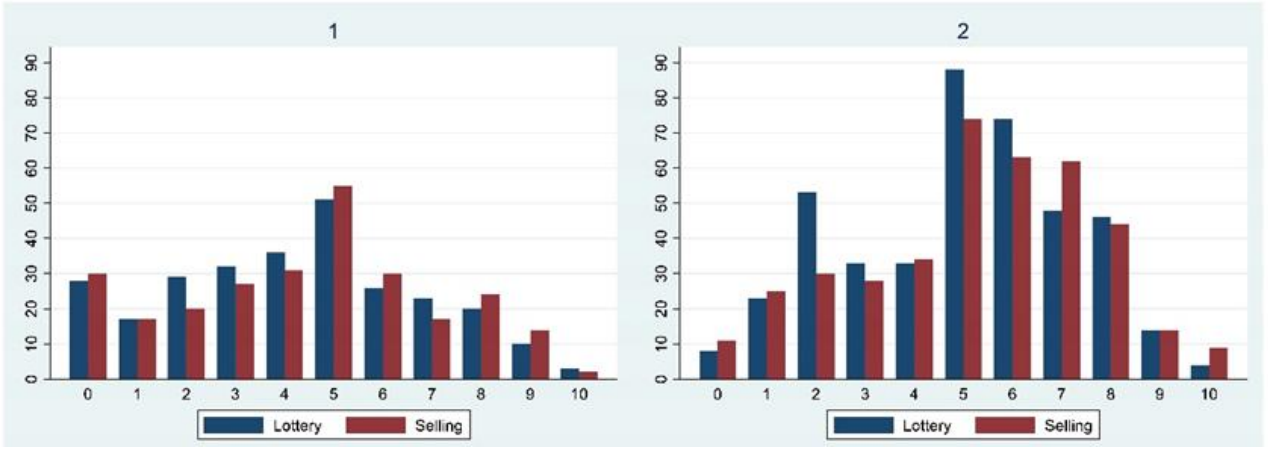
Household characteristics

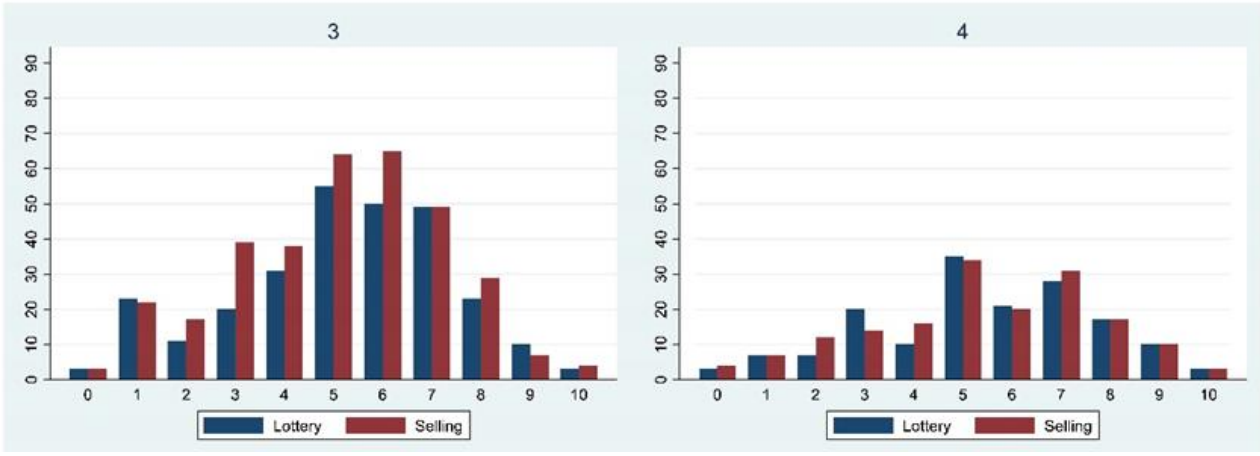
- N 848

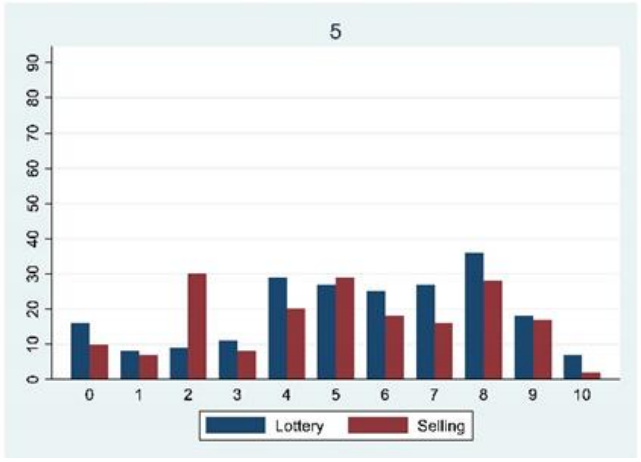
	Mean	Std. dev.	Min.	Max.
Distance to livestock market (in m)	7,973.75	10,095.33	100	45,000
Household size	6.5165009	2.427647	1	17
Herd size	24.28538	30.42099	1	437
Number of species	2.211085	0.9810578	1	6
Farm income share	0.3539805	0.3648085	0	1

Descriptive statistics

Reported risks preferences by livestock keepers in LiK (2016)







Estimation results

	A (self-assessment)	B (self-assessment)	C (lottery)	D (selling)
Primary education (Scale 2-3)	- (omitted)	12.57945	11.71286	13.24845
Secondary education (Scale 4-6	9.852967	12.23607	11.70429	12.45559
Tertiary education (7-8)	11.06565	13.04591	12.15837	13.23274
Age (years)	-0.005657	0.0026389	-0.0037239	-0.001146
Male	-0.8499977**	-0.6331765***	-0.2018159	-0.1008589
Distance to next livestock market (in m)	0.00000875	0.00000259	-0.0000392***	-0.0000404***
Household size	0.0789896	0.0824613**	-0.0336861	-0.026203
Farm income share	-0.6717544	0.134355	0.5047596*	0.684002**
Total herd size	-0.0188611	-0.0031326	-0.001421	-0.0008171
Number of species	0.1841396	-0.3818872***	-0.009601	-0.0141486
Number of hot summer months	0.3831237	0.2825618**	-0.2546909*	-0.152105
Number of cold winter months	0.3234319	-0.2533933*	0.3644645**	0.5007458***
Number of high rainfall months	0.1053521	0.1784181***	-0.2005933**	-0.2029046**
Number of low rainfall months	-1.816984***	-0.8244072***	0.5034485**	0.4352651**
Number of heavy snowfall months	0.0688108	0.0141638	-0.2004334**	-0.1802967*
Constant	-14.00672	-12.61506	-11.88838	-13.37469
Observations	1,340	1,351	1,351	1,351
Pseudo R^2	0.1062	0.0950	0.0339	0.0413

Notes: * p<0.05, **p<0.01, ***p<0.001

Robustness test of the results: extensions

Robustness test	Self assessment					Lottery				Selling			
Primary education (Scale 2-3)													
Secondary education (Scale 4-6													
Tertiary education (7-8)													
Age (years)													
Male			-*					-*					-*
Distance to next livestock market (in m)		+*					-*				-*		
Household size		+*											
Farm income share						+*		-*		+*			
Total herd size													+*
Number of species			-*										
Number of hot summer months			+*			-*						+*	
Number of cold winter months			-*			+*				+*			
Number of high rainfall months			+*				-*				-*		
Number of low rainfall months			-*			+*					+*		
Number of heavy snowfall months				-*		-*				-*		+*	
Constant					+**								

Notes: * p<0.05

Discussion

- Weather shocks and risk aversion are significantly correlated, but estimation results vary between and within models

  → Certain weather shocks (e. g. low rainfall, cold winter) lead to risk aversion in incentivized measures (‘house-money effect), but to risk-seeking in self-assessments (‘break-even-hypothesis’)

  →Not equally perceived as shocks by livestock keepers

- **Psychology:** Emotional reactions towards risks can differ from cognitive evaluations of risks (Loewenstein et al., 2001)

- Self-reports rarely predict incentivized risks preferences (Bauer et al. 2019; Finger et al. 2022; Maart-Noelck & Mußhoff, 2013)

- Female livestock keepers are less risk-seeking than male (e. g. Hanaoka et al., 2015; Liu, 2013; Maart-Noelck & Mußhoff, 2013)

Limitations

- Most respondents of risks preferences lay in the middle range, which might be traced back to the indifference (e. g. Nielsen et al., 2012)
- Findings suggest that spatial factors are involved in the determination of risks preferences, which could be explained by similar weather patterns
- General risks preferences have limited explanatory power to predict risk management in agricultural production and insurance decisions (e. g. Rommel et al., 2018)
- With-without approach only a first step → Tracking panel data to observe changes in risks preferences over time seems more promising (e. g. Finger et al., 2022)

Conclusions

- Weather extremes shape risks preferences of livestock keepers
- Weather extremes are perceived differently by livestock keepers (e. g. intense rainfall as gain)
- Results are not necessarily limited to livestock keepers, as the response behavior of all individuals was similar
- Findings are important for policymakers as for the establishment of local insurance markets
- Using different elicitation methods of risks preferences can lead to contradicting estimation results
- Research and policy should not rely on one single elicitation method for measurement of risks preferences (cf. Finger et al., 2022)

Thank you for your attention!

Literature

1) Adema, J., Nikolka, T., Poutvaara, P., & Sunde, U. (2022). On the stability of risk preferences: Measurement matters. Economics Letters, 210, 110172.
2) Bauer, M., Chytilová, J., & Miguel, E. (2020). Using survey questions to measure preferences: Lessons from an experimental validation in Kenya. European Economic Review, 127, 103493.
3) Broka, S., Giertz, Å., Christensen, G., Hanif, C., Rasmussen, D., & Rubaiza, R. (2016). Kyrgyz Republic Agricultural Sector Risk Assessment. Agriculture global practice technical assistance paper, Washington D.C.: World Bank.
4) Charness, G., Gneezy, U., & Imas, A. (2013). Experimental methods: Eliciting risk preferences. Journal of Economic Behavior & Organization, 87, 43-51.
5) Chuang, Y., & Schechter, L. (2015). Stability of experimental and survey measures of risk, time, and social preferences: A review and some new results. Journal of development economics, 117, 151-170.
6) Conti, V., Sitko, N. J., & Ignaciuk, A. (2018). How do extreme weather events affect livestock herders' welfare? Evidence from Kyrgyzstan. FAO Agricultural Development Economics Working Paper 18-07. Rome: FAO, 1-28.
7) FAO (2015). Climate change and food security: risks and responses. Food and Agriculture Organization of the United Nations (FAO) Report. Rome: FAO.
8) Fay, M., Block, R., & Ebinger, J. (Eds.). (2010). Adapting to climate change in Eastern Europe and Central Asia. Washington D.C: World Bank.

Literature

1) Finger, R., Wüpper, D., & McCallum, C. (2022). The (in) stability of farmer risk preferences. Journal of Agricultural Economics.

2) Freudenreich, H., Mußhoff, O., & Wiercinski, B. (2017). The relationship between farmers' shock experiences and their uncertainty preferences - experimental evidence from Mexico. GlobalFood Discussion Papers, No. 92, Göttingen: Georg-August- Universität Göttingen, Research Training Group (RTG) 1666 - GlobalFood.

3) Gloede, O., Menkhoff, L., & Waibel, H. (2015). Shocks, individual risk attitude, and vulnerability to poverty among rural households in Thailand and Vietnam. World Development, 71, 54-78.

4) Gujarati, D. N., Porter, D. C., & Gunasekar, S. (2012). Basic econometrics (5th ed.). Boston, Massachusetts: Mcgraw-hill Irwin.

5) Hanaoka, C., Shigeoka, H., & Watanabe, Y. (2015). Do Risk Preferences Change? Evidence from Panel Data before and after the Great East Japan Earthquake. National Bureau of Economic Research Working Papers No 21400, Cambridge, Massachusetts: National Bureau of Economic Research.

6) Life in Kyrgyzstan Study (2013). Research Data Center of IZA (IDSC). Version 1.0, https://dx.doi.org/10.15185/izadp.7055.1.

7) Liu, E. M. (2013). Time to change what to sow: Risk preferences and technology adoption decisions of cotton farmers in China. Review of Economics and Statistics, 95(4), 1386–1403.

8) Loewenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. Psychological bulletin, 127(2), 267-286.

Literature

1) Maart-Noelck, S. C., & Mußhoff, O. (2013). Measuring the risk attitude of decision-makers: are there differences between groups of methods and persons? Australian Journal of Agricultural and Resource Economics, 58(3), 336-352.
2) Meraner, M. & Finger, R. (2019). Risk perceptions, preferences and management strategies: evidence from a case study using German livestock farmers, Journal of Risk Research, 22(1), 110-135.
3) NASA POWER (2022) DATA Access Viewer. Retrieved from https://power.larc.nasa.gov/data-access-viewer/.
4) Nielsen, T., Keil, A., & Zeller, M. (2013). Assessing farmers' risk preferences and their determinants in a marginal upland area of Vietnam: a comparison of multiple elicitation techniques. Agricultural Economics, 44(3), 255-273.
5) NOAA NCEI (2022). Past Weather: Kyrgyzstan. Retrieved from https://www.ncei.noaa.gov/access/past-weather/Kyrgyzstan.
6) Osborne, J. W., & Overbay, A. (2004). The power of outliers (and why researchers should always check for them). Practical assessment, research and evaluation, 9(6), 1-12.
7) Reynaud, A., & Aubert, C. (2020). Does flood experience modify risk preferences? Evidence from an artefactual field experiment in Vietnam. The Geneva Risk and Insurance Review, 45(1), 36-74.
8) Reynaud, A., & Aubert, C. (2020). Does flood experience modify risk preferences? Evidence from an artefactual field experiment in Vietnam. The Geneva Risk and Insurance Review, 45(1), 36-74.

Literature

1) Robinson, S. (2020). Livestock in Central Asia: From rural subsistence to engine of growth? Discussion Paper, No. 193, Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Halle (Saale).
2) Rommel, J., Hermann, D., Müller, M., & Mußhoff, O. (2018). Contextual framing and monetary incentives in field experiments on risk preferences: evidence from German farmers. Journal of Agricultural Economics, 70(2), 408-425.
3) Schildberg-Hörisch, H. (2018). Are risk preferences stable? Journal of Economic Perspectives, 32(2), 135-54.
4) Secretariat of the United Nations International Strategy for Disaster Reduction (UNISDR) - Sub-Regional Office for Central Asia and Caucasus (2007). In-depth Review of Disaster Risk Reduction in the Kyrgyz Republic. UNISDR-Sub-Regional Office for Central Asia and Caucasus.
5) Stigler, G. J., & Becker, G. S. (1977). De gustibus non est disputandum. The american economic review, 67(2), 76-90.
6) Thaler, R. H., & Johnson, E. J. (1990). Gambling with the house money and trying to break even: The effects of prior outcomes on risky choice. Management science, 36(6), 643-660.
7) Wilson, R. T. (1997). Livestock, pastures, and the environment in the Kyrgyz Republic, central Asia. Mountain Research and Development, 17(1), 57-68.
8) World Bank (2017). Measuring Seismic Risk in Kyrgyz Republic: Seismic Risk Reduction Strategy. Washington D.C.: World Bank.

Thank you for your attention!